

CLAIMS

1. Method for manufacturing precured parts from a composite material with J-section beams applied in an uncured condition, in which are structurally joined at least two parts made from composite materials, of which a first part known as a base or skin (3) is cured and a second part or parts known as beams (2) are uncured, and in which the two parts are joined by a layer of structural adhesive so that the second part is compacted against the first with a suitable cross linking of the resin of the composite material, and so strongly bonded to the skin of the first part that the required strength of the adhesive layer is ensured, characterized by the following stages:

laminating superposed layers of preimpregnated composite material so that the fiber orientation is adapted to the structural requirements of the part to be obtained, producing from the resulting laminates on one hand the base part and on another a set of basic stacks used to form the second part;

curing the base part in an autoclave;

cutting the flat laminate with areas of different thickness from which the second parts are obtained;

assembling packages from the patterns obtained in the previous cutting;

hot forming in two cycles, applying heat and vacuum, of the previously obtained flat configurations to obtain a preform with a J-shaped cross-section;

mounting the preforms on the curing tools on auxiliary preassembly benches which simplify this task;

precise positioning of all tooling (rigid tools (1) + rakes (22)) and J-shaped parts on the precured base;

mounting a previously made and checked vacuum bag (14);

overturning the part and the tool to a vertical position when the parts have a large area and are difficult to access, performing the fine adjustment of

the vacuum bag in this position;
and performing the autoclave curing cycle.

5 2. Method as claimed in claim 1, characterized in that
the base part and one or more second parts are joined to
obtain a precured finished part.

10 3. Method as claimed in any of the previous claims,
characterized in that the elements to be bonded in an
uncured state are obtained from flat laminates with a
varying thickness in different areas, which are later cut
and stacked in packages until the final configuration of
the part, stacking packages of at least two cloths and in
no case placing one cloth against another.

15 4. Method as claimed in any of the previous claims,
characterized in that the elements to be bonded in an
uncured state are hot formed to obtain preforms with the
final geometry, so that they can be easily mounted on the
curing tools (rigid tools (1)).

20 5. Method as claimed in any of the previous claims,
characterized in that the hot forming tools are made of
aluminum with improved wood on their upper part which is
in contact with the fiber, in order to prevent heat
transfer losses, as well as losses of the integrated
vacuum system used in the overturning operation of said
tools.

25 6. Method as claimed in any of the previous claims,
characterized in that the curing tools (1) have a section
with a rectangular trapezoid shape so that the
geometrical quality of the part is ensured, allowing to
adjust the upper side of the beams (2) to another part of
30 the base part type.

35 7. Method as claimed in any of the previous claims,
characterized in that the curing tools (1) are made of

invar to prevent deformations due to thermal expansion during the autoclave cycle.

5 8. Method as claimed in any of the previous claims, characterized in that between the edge (20) of the rigid tool (1) and the radius of the foot of the beam (2) there is a 3 mm separation that ensures the geometrical quality of the part, as well as demolding of same.

10 9. Method as claimed in any of the previous claims, characterized in that the autoclave curing takes place at a pressure between 586 kPa and 896 kPa and at a temperature of up to 190 °C, depending on the composite material used, with a heating gradient of 0.5 to 2°C/min.

15 10. Method as claimed in any of the previous claims, characterized in that parts are obtained that can be applied to structures and controls of aerospace, marine and land vehicles, as well as to industrial machinery and equipment.

20 11. Method as claimed in any of the previous claims, characterized in that the base part (skin (3)) consists of the skin of an airplane wing, a stabilizer or any other element that requires stiffening to fulfill its structural function.

25 12. Method as claimed in any of the previous claims, characterized in that the uncured parts have a J-shaped cross section.

30 13. Method as claimed in any of the previous claims, characterized in that the uncured parts have a thickness between 1 mm and 6 mm, and in that the base part has a length of up to 7 m, with a delta shape.

35 14. Method as claimed in any of the previous claims, characterized in that the vacuum bag (14) has large

dimensions and for this reason it is traced in a numerical control machine and made prior to being placed.

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15. Method as claimed in any of the previous claims, characterized in that the composite material consists of fibers and resins chosen from among glass fiber, carbon fiber, aramid fiber, boron fiber, epoxy resin, thermoplastic resin and other thermosetting resins.

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